Fluorinated Hydrocarbons as MRI Contrast Agents

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MRI contrast agents have been widely used to enhance tumor detection and improve tumor image quality. Particulate MRI contrast agents using conventional proton magnetic resonance imaging have met with limited success. Herein, we report a process to microencapsulate fluorinated hydrocarbons in a biocompatible protein shell and their efficacy as contrast agents for fluorine magnetic resonance imaging (^{19}F MRI).

This techniques allows for the delivery of fluorocarbons (e.g., perfluorononane) in a biocompatible form. The fluorocarbon containing microcapsules have a narrow size distribution with an average diameter of approximately 2 microns. Upon intravenous injection, the particles are rapidly scavenged by the macrophages of the reticuloendothial cell (RES) system. This specific macrophagic uptake introduces organ specificity (e.g., the liver and spleen).

In vivo ^{19}F MRI and ^{1}H MRI of rats (Fischer 344, 300 g) were easily obtained using a 4.7 Tesla Oxford superconducting magnet. ^{19}F magnetic resonance images of the entire rat as well as individual organs such as the liver, spleen and kidney were obtained using a T_1 weighted sequence with TR=1 second, TE=20 milliseconds and a data matrix of 256x128.

Overall, excellent quality fluorine images showing liver and spleen morphology were obtained demonstrating the potential of this technique in the diagnosis and localization of the abnormal pathology within the RES containing organs. MR imaging with fluorine enables selected areas to be imaged without interference or complication from surrounding protons. This technique is superior over proton MRI solid or fluid microparticles, in that the fluorocarbon-microcapsule itself is the source of the MRI signal. The microparticulate contrast agents rely only on the distribution of free water and its interaction to produce the observed image.

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